US009233040B2

(12) **United States Patent**
Matsubara et al.

(10) **Patent No.: US 9,233,040 B2**
(45) **Date of Patent: Jan. 12, 2016**

(54) **INFANT INCUBATOR**

(71) Applicant: **ATOM MEDICAL CORPORATION**, Bunkyo-ku, Tokyo (JP)

(72) Inventors: **Kazuo Matsubara**, Tokyo (JP); **Terumi Matsubara**, Saitama (JP); **Shinichi Kobayashi**, Saitama (JP); **Kenji Kobayashi**, Saitama (JP)

(73) Assignee: **ATOM MEDICAL CORPORATION**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 180 days.

(21) Appl. No.: **13/858,663**

(22) Filed: **Apr. 8, 2013**

(65) **Prior Publication Data**

US 2013/0274543 A1 Oct. 17, 2013

(30) **Foreign Application Priority Data**

Apr. 11, 2012 (JP) 2012-90486

(51) **Int. Cl.**
A61G 11/00 (2006.01)

(52) **U.S. Cl.**
CPC ***A61G 11/001*** (2013.01); ***A61G 11/002*** (2013.01); ***A61G 11/005*** (2013.01); ***A61G 11/006*** (2013.01); ***A61G 11/009*** (2013.01); *A61G 11/003* (2013.01)

(58) **Field of Classification Search**
USPC 600/22
See application file for complete search history.

(56) **References Cited**

FOREIGN PATENT DOCUMENTS

JP 2010-99243 A 5/2010

Primary Examiner — Christine H Matthews
(74) *Attorney, Agent, or Firm* — Arent Fox LLP

(57) **ABSTRACT**

An infant incubator including: a left-side treatment door, a right-side treatment door, and an end-side treatment door which are rotatably held, and door-locking devices which fixes the left-side and right-side treatment doors on the end-side treatment door; the door-locking devices are formed from: open-close knobs each mounted rotatably on the left-side and right-side treatment doors and each having a hook-shaped distal end, and knob brackets each mounted on side of the end-side treatment doors having a hollow-shape, the infant incubator in which the treatment doors are fixed in a stand state by inserting the open-close knob into the knob bracket.

9 Claims, 14 Drawing Sheets

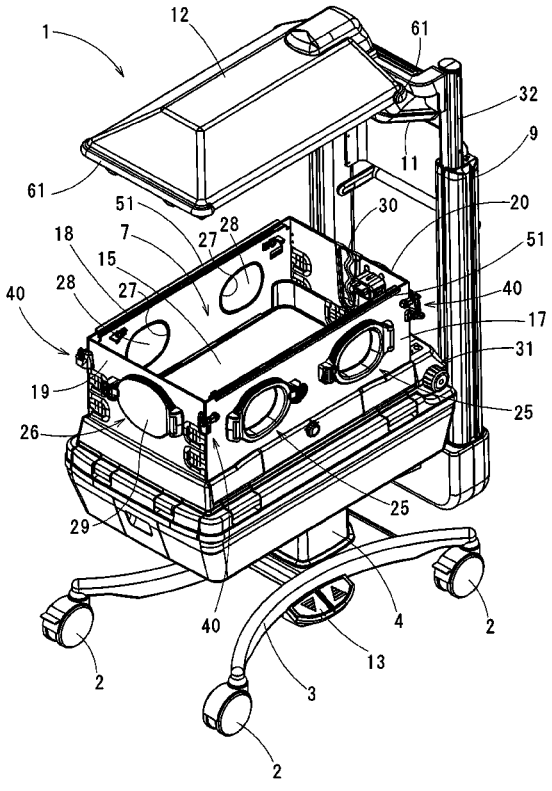


FIG. 1

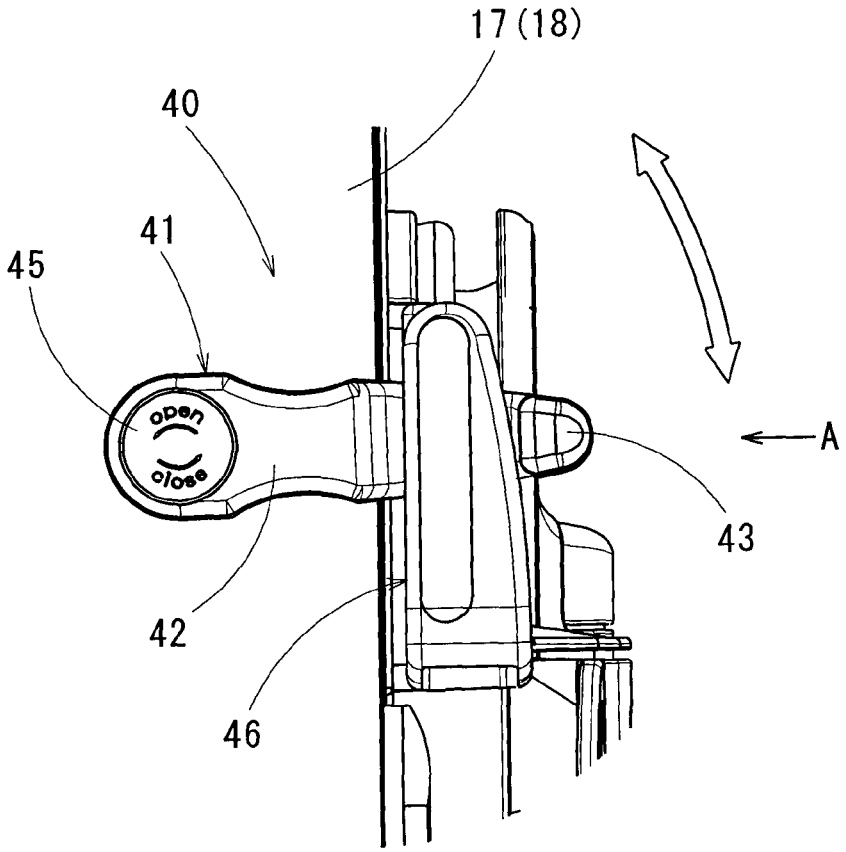


FIG. 2

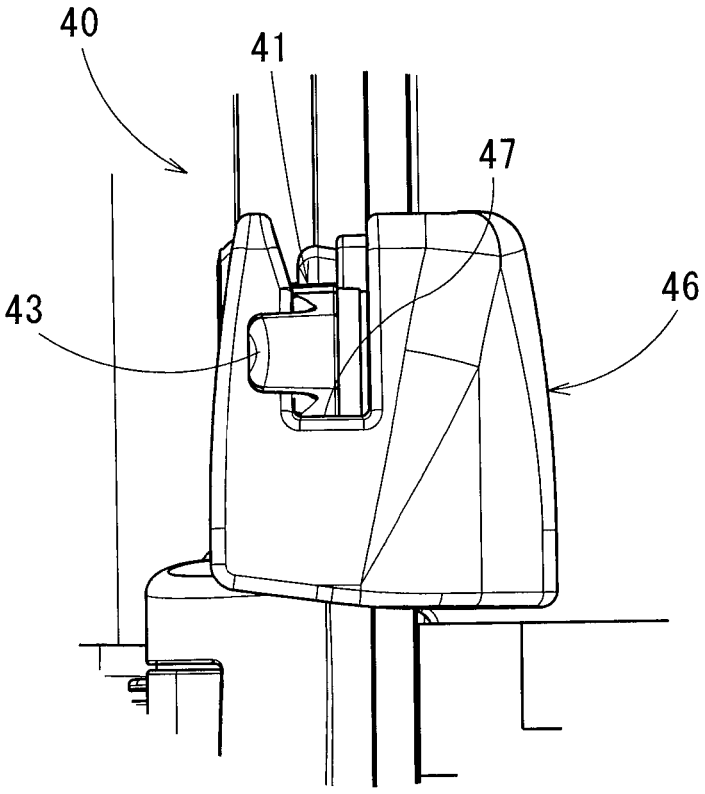


FIG. 3

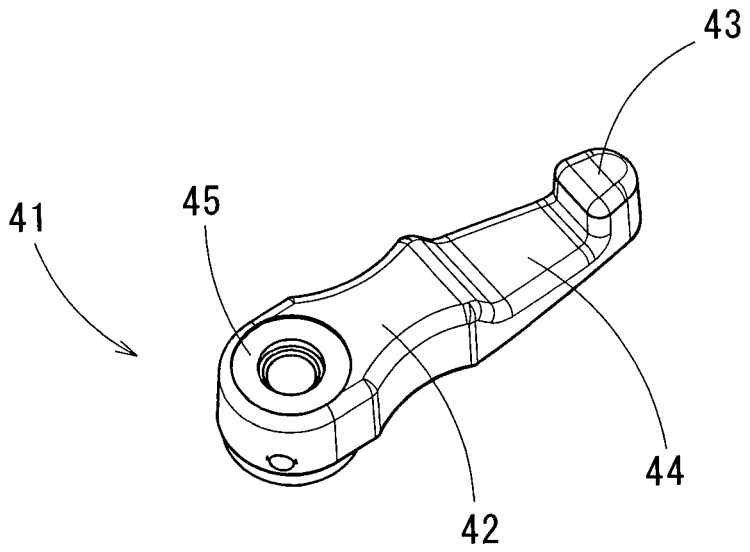


FIG. 4

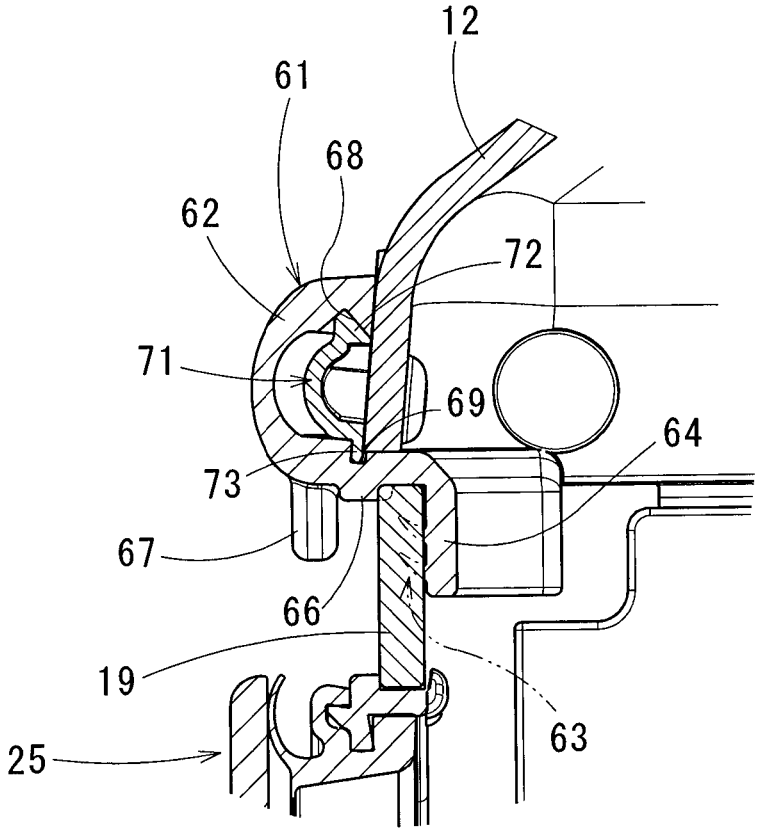


FIG. 5

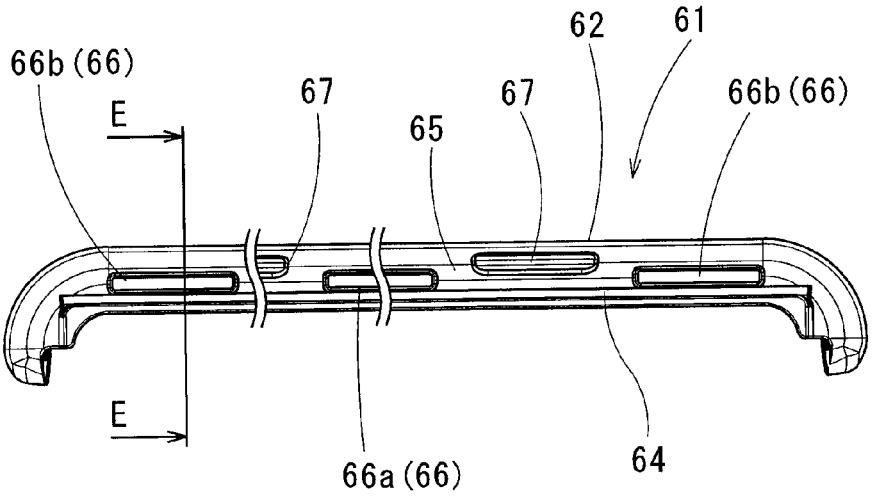


FIG. 6

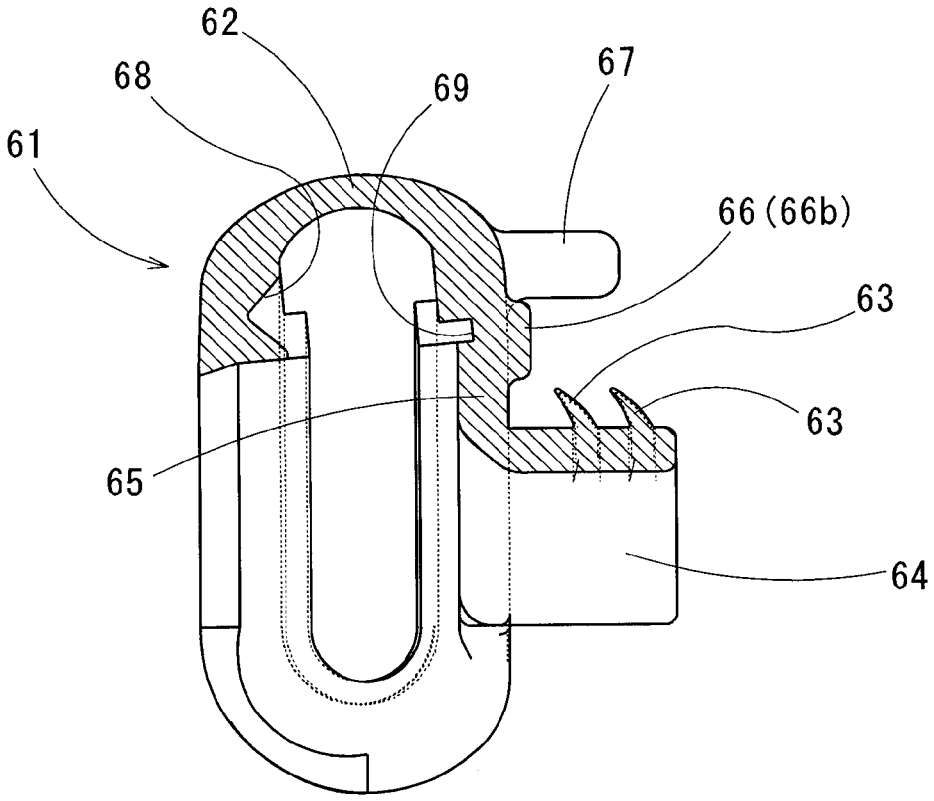


FIG. 7

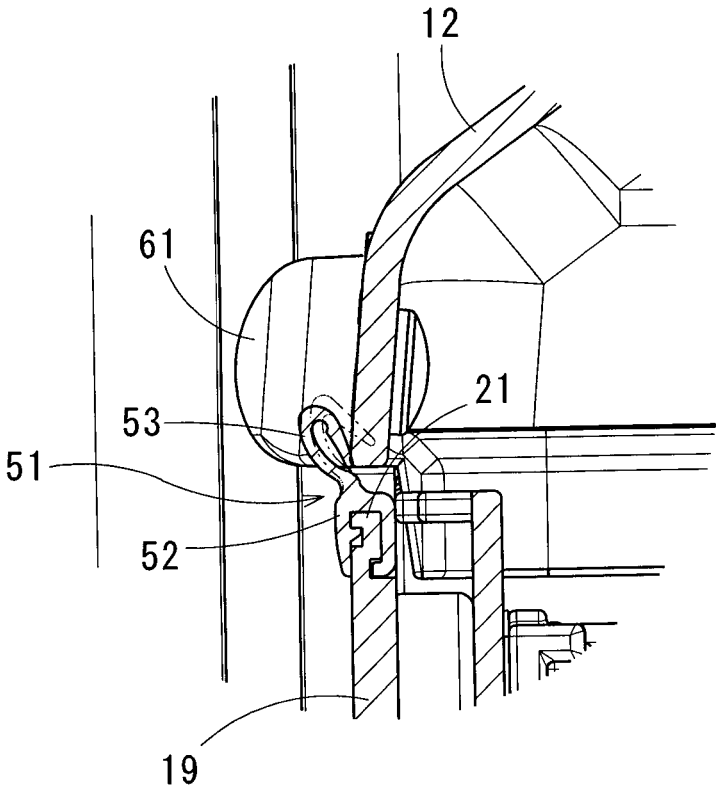


FIG. 8

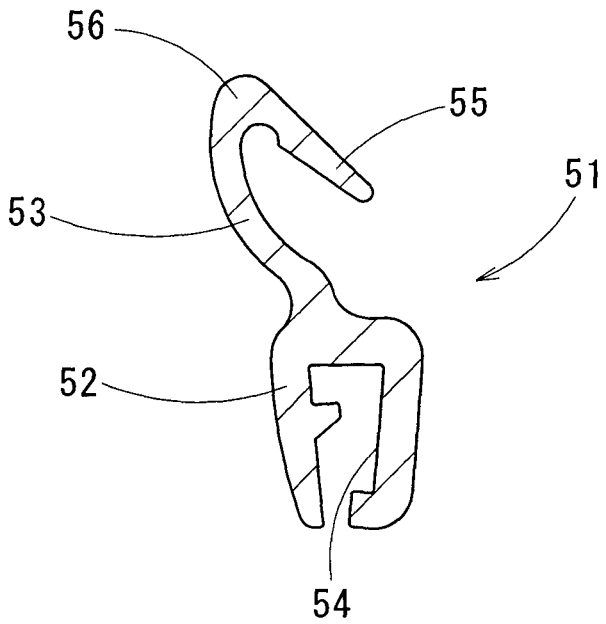


FIG. 9

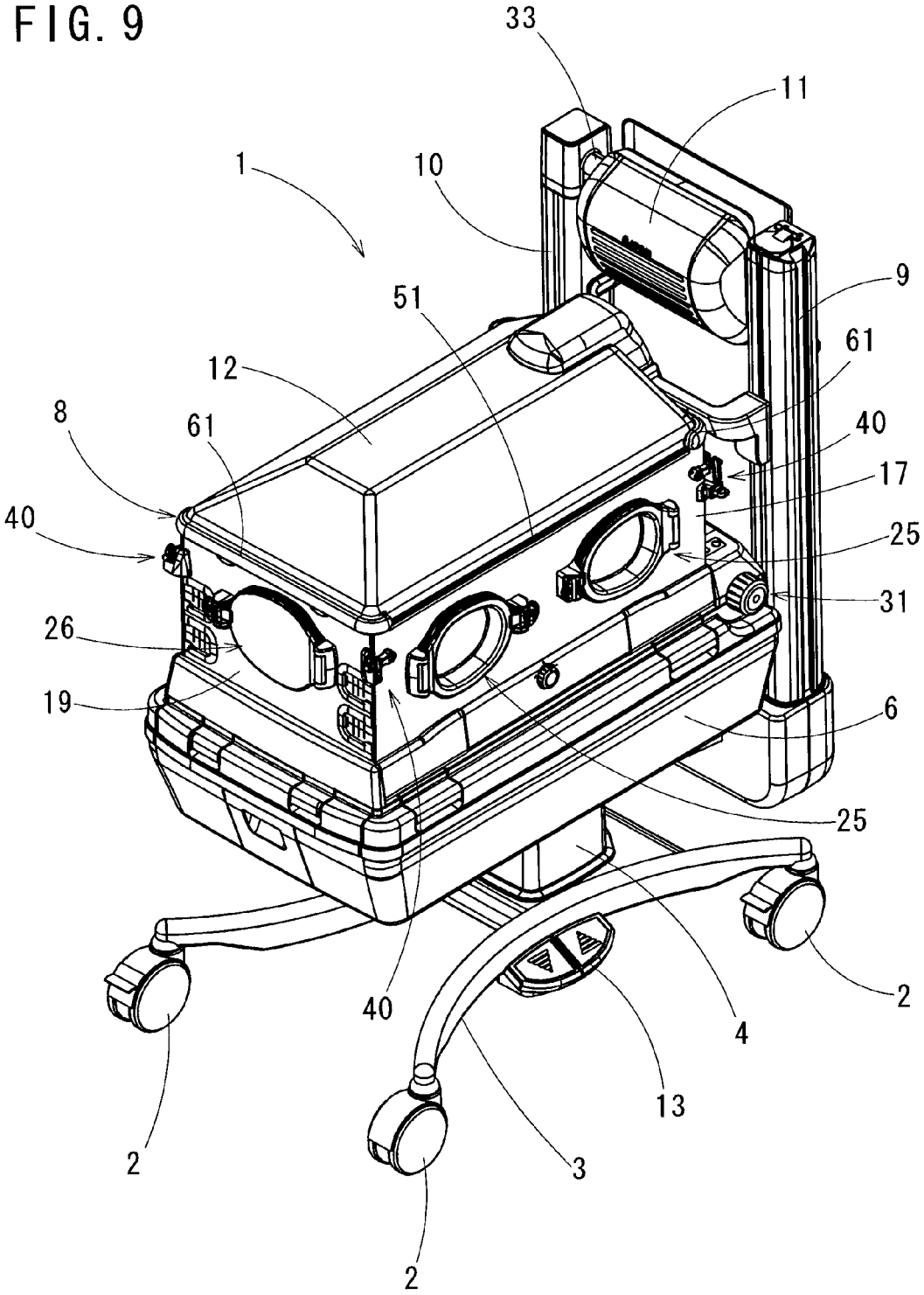


FIG. 10

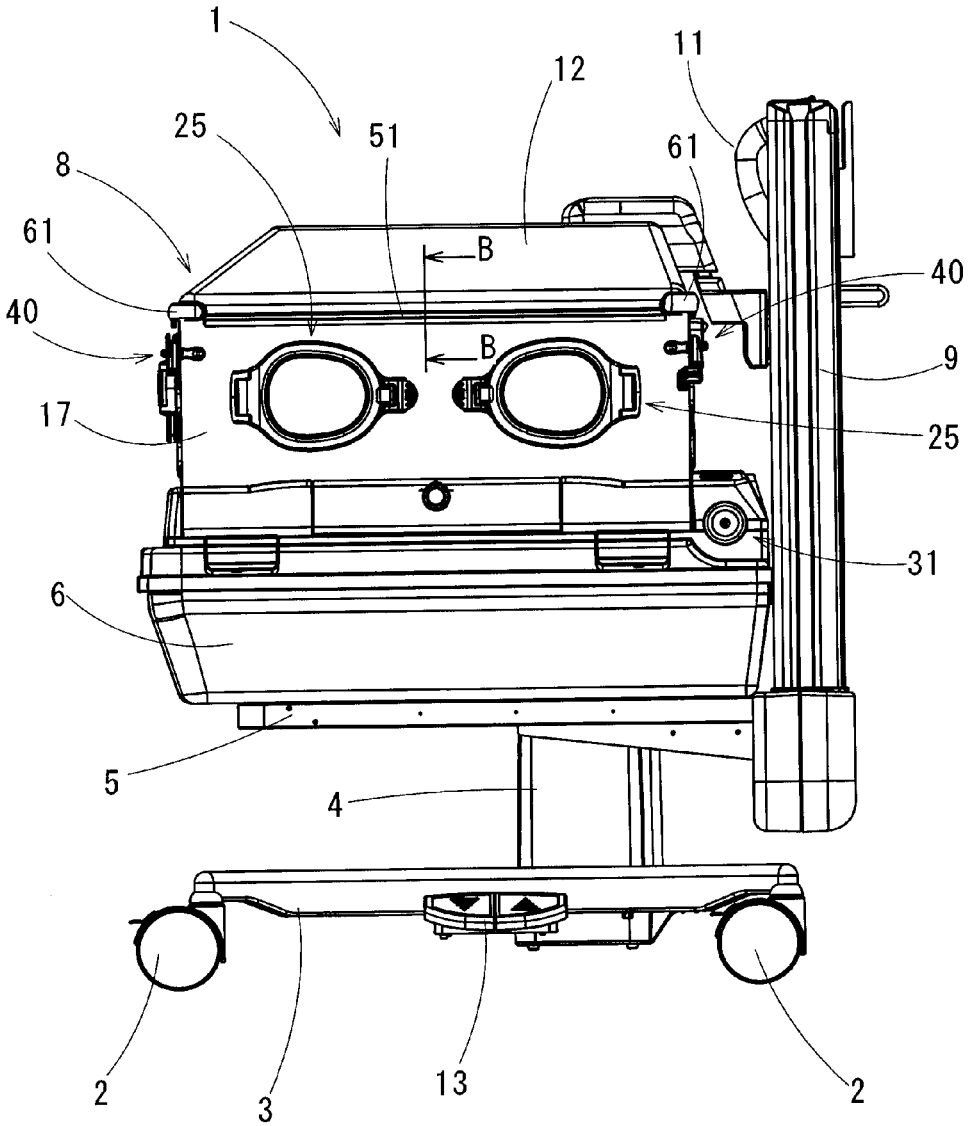


FIG. 11

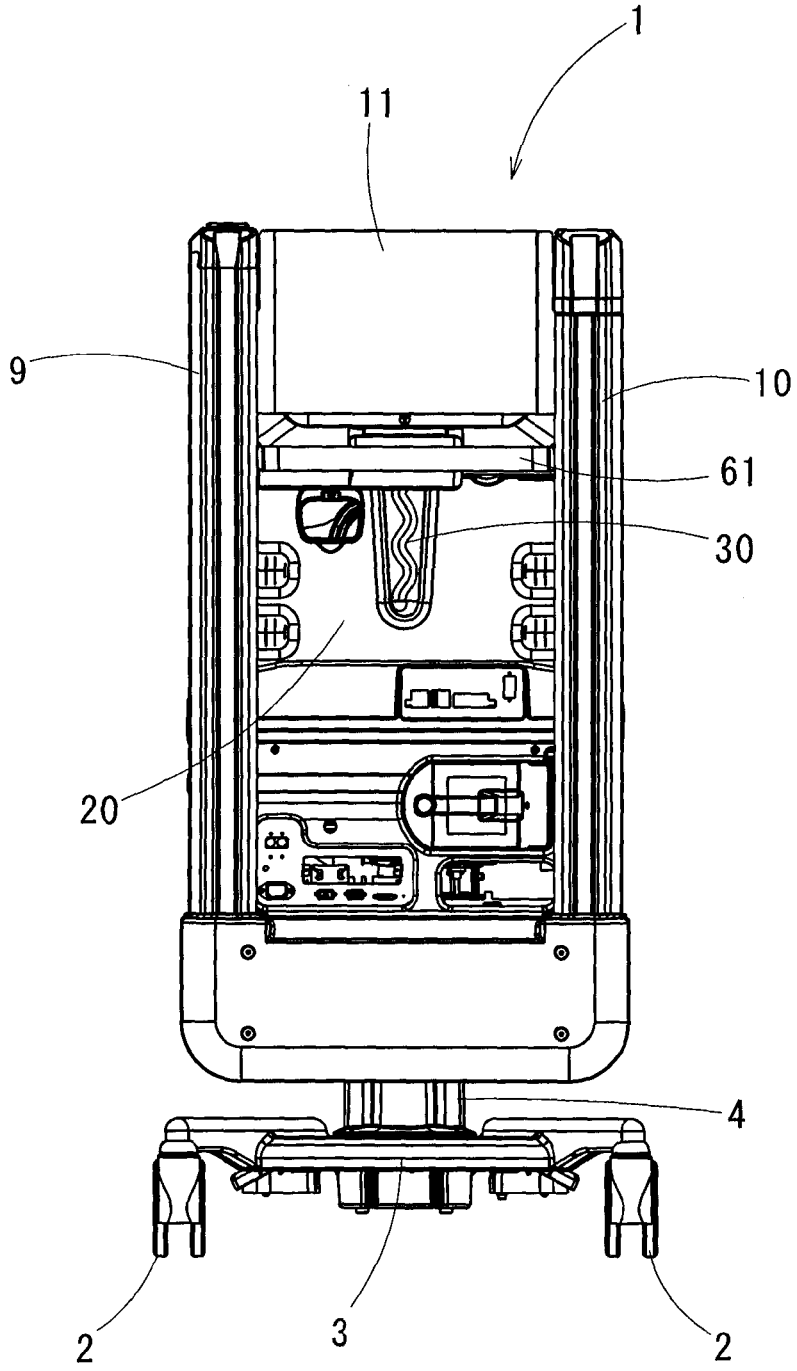


FIG. 12

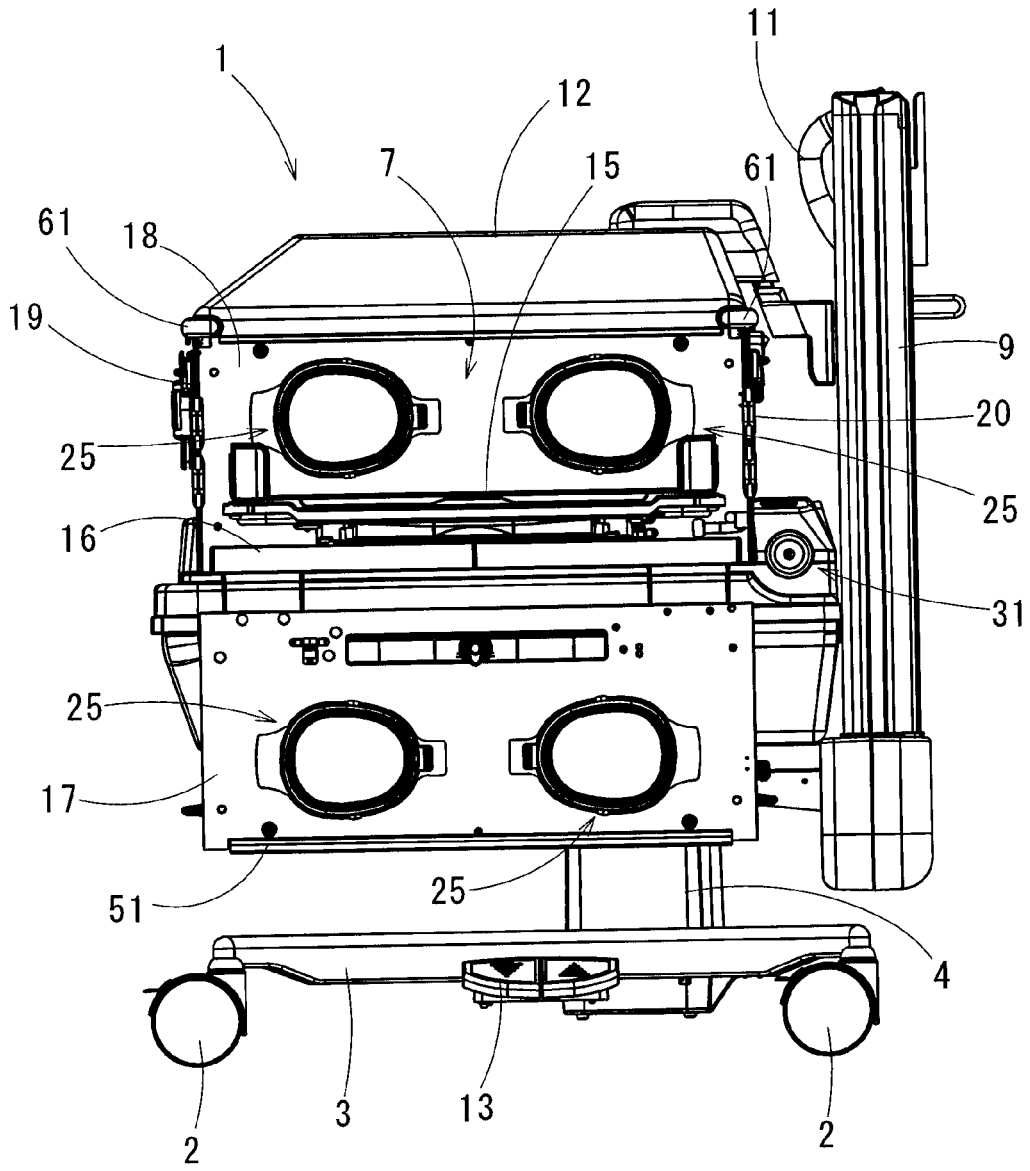


FIG. 13

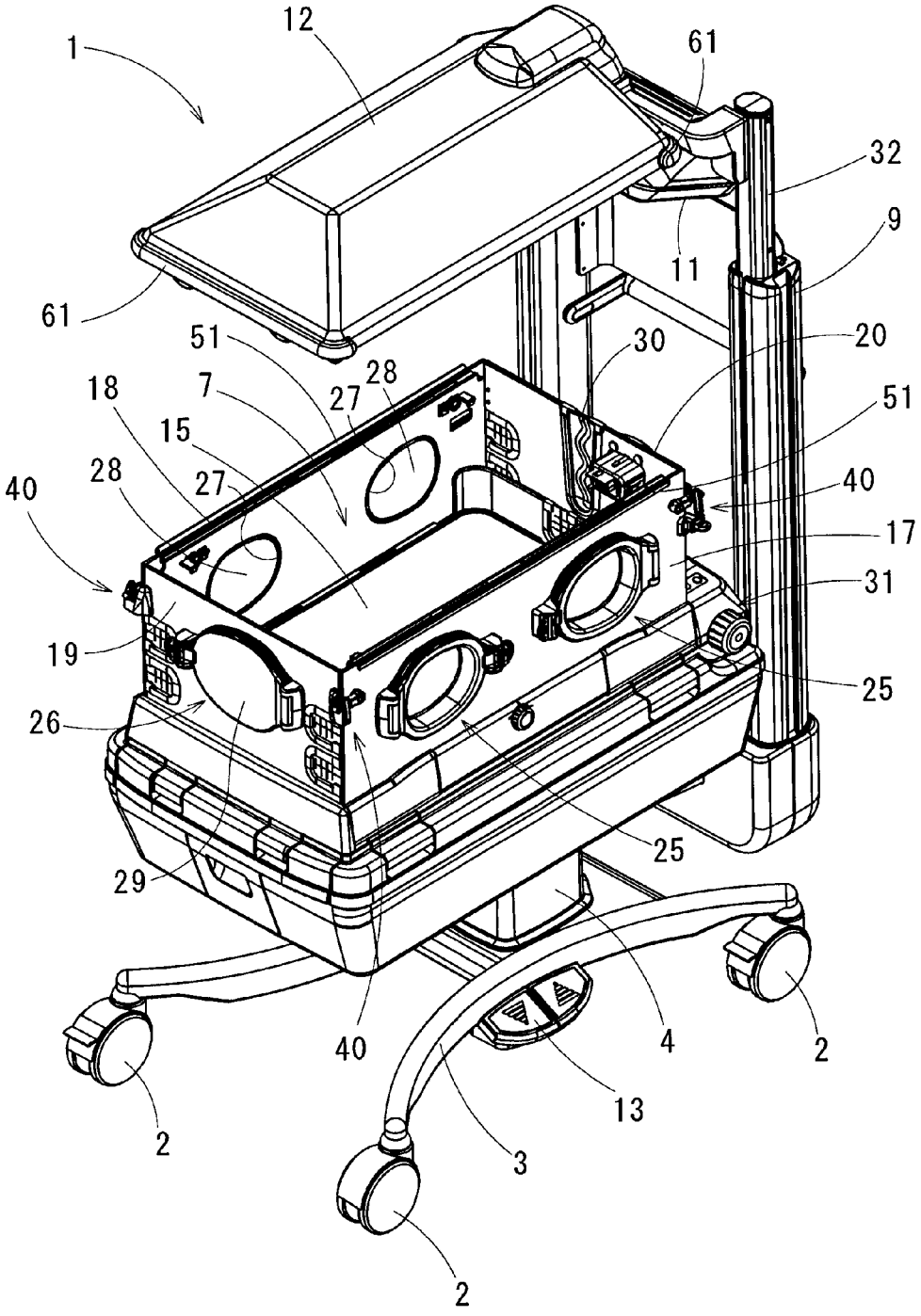
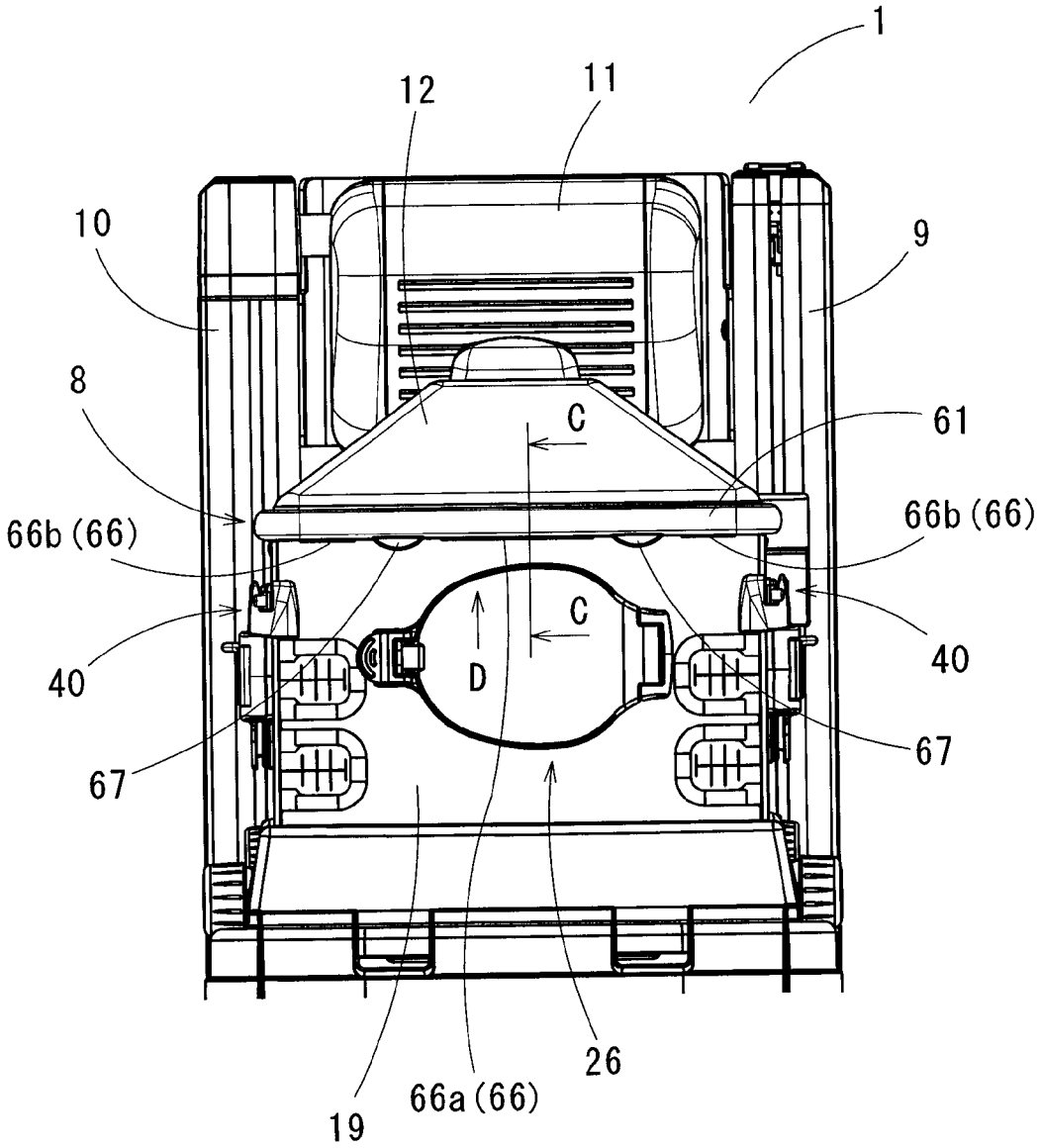

1
12
61
32
9
11
61
51
30
20
18
7
27
28
15
51
28
27
40
40
17
31
19
25
26
25
29
40
4
2
13
2
3
2

FIG. 14



INFANT INCUBATOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an infant incubator having two functions, both of an enclosed incubator in which an infant chamber is in a closed state and an open incubator in which an infant chamber is in an open state.

Priority is claimed on Japanese Patent Application No. 2012-90486, filed Apr. 11, 2012, the content of which is incorporated herein by reference.

2. Description of the Related Art

Japanese Unexamined Patent Application, First Publication No. 2010-99243 suggests a switchable infant incubator which can be switched as needed between states of an enclosed infant incubator and a closed infant incubator by moving up and down a canopy of a hood forming an infant chamber, in which the canopy is separated from a side wall of the hood.

In such a switchable infant incubator, the side wall of the hood is formed by four walls of left and right-side treatment doors which are disposed at the left-side and the right-side and end-side treatment doors which are disposed at the head side and the foot side. The side walls of the hood formed from those treatment doors of the four walls are fitted with the canopy, so that the enclosed infant incubator is formed. The left and right-side treatment doors and the foot-side treatment door can be open individually by turning down. Medical advices, treatments and the like for an infant can be operated from any sides by opening one or more treatment doors lateral of the infant chamber.

SUMMARY OF THE INVENTION

Problems to be Solved by the Invention

In open state of the infant incubator, the left and right-side treatment doors and the foot-side treatment door are open and closed when treating the infant. On the other hand, in closed state of the infant incubator, the left and right-side treatment doors are open and closed when treating the infant. Therefore, in the closed state, it is unnecessary to open and close the foot-side treatment door (i.e., the end-side treatment door); and further it is necessary not to enable the foot-side treatment door to carelessly be open and closed for maintaining environment in the infant chamber.

The present invention is achieved in consideration of the above circumstances, and has an object to provide an infant incubator in which an end-side treatment door of a hood can be surely locked when left and right-side treatment doors of the hood are locked in closed state; and the left and right-side treatment doors and the end-side treatment door of the hood can be easily open in open state.

Means for Solving the Problem

The present invention is an infant incubator having an infant chamber which can switch states between a closed state and an open state by opening and closing a hood, wherein: the hood includes a side wall part and a canopy which is separated from the side wall part and can be moved up and down, the side wall part includes: a left-side treatment door disposed at a left-side of an infant and a right-side treatment door disposed at a right-side of the infant, which are rotatably held between an erection state and open state; an end-side treatment door disposed at at least one of a head side or a foot side of the infant, which is rotatably held between the erection state and open state; and door-locking devices which lock the left-side treatment door and the right-side treatment door with the end-side treatment door with each other, each of the door-locking devices includes: an open-close knob which is attached to the left-side treatment door or the right-side treatment door and has a hook end; and a knob bracket which is attached to a side of the end-side treatment door and has a hollow portion to which the hook end is engaged, and the left-side treatment door and the right-side treatment door are fixed with the end-side treatment door in the erection state by engaging the hook end of the open-close knob and the hollow portion of the knob bracket.

Since the open-close knob has the hook end, the end-side treatment door can be locked using the door-locking devices of the left and right-side treatment doors although it is a simple mechanism, so that the end-side treatment door can be prevented from opening carelessly. Moreover, when the treatment doors are open, the left and right-side treatment doors and the end-side treatment door can be easily open by releasing the engagement of the open-close knob and the knob bracket.

Regarding the end-side treatment door, the head side and the foot side is set in accordance with a posture of the infant.

In the infant incubator according to the present invention, the canopy has a canopy gasket which is in contact with an top end portion of the end-side treatment door and maintains the canopy to close to the end-side treatment door in the closed state, the canopy gasket is provided with a vertical-wall portion having a sealing portion which is in contact with an inner surface of the end-side treatment door and a protruded ridge which is provided along an outer surface of the end-side treatment door, and the top end portion of the end-side treatment door is fitted between the vertical-wall portion and the protruded ridge in the closed state.

When the canopy and the treatment doors are closed, it is necessary to adjust positions of the canopy and the treatment doors accurately in order to maintain a sealing property of the infant chamber. Therefore, the canopy gasket which maintains the canopy to close to the end-side treatment door has the abovementioned vertical-wall portion and the protruded ridge so that the position of the canopy and the end-side treatment door can be adjusted. As a result, the positions of the canopy and the end-side treatment door can be adjusted, so that the gap between the canopy and the end-side treatment door can be surely sealed and maintained to be closed.

Furthermore, the end-side treatment door can be maintained in the erection state by the canopy gasket, so that the end-side treatment door is restricted to move to the open state, and it can be prevented to be open or closed improperly.

In the infant incubator according to the present invention, it is preferable that the canopy gasket be provided so that a part of the protruded ridge reaches to an outer periphery of an top end surface of the end-side treatment door.

In this case, the end-side treatment door is pressed toward inside an infant treatment room by the protruded ridge in the closed state, so that a sealing performance between the canopy and the end-side treatment door can be improved, and the end-side treatment door can be prevented from being open or closed improperly.

In the infant incubator according to the present invention, it is preferable that the canopy gasket be provided with a protruded portion at an outside of the protruded ridge so as to protrude higher than the protruded ridge.

By providing the protruded portion which is formed higher than the protruded ridge, a double wall is set with respect to

the end-side treatment door. As a result, the end-side treatment door can be reliably prevented from being open or closed improperly.

Effects of the Invention

According to the infant incubator of the present invention, since the left-side and right-side treatment doors and the end-side treatment door share the door-locking device, the end-side treatment door can also be reliably locked when the left-side and the right-side treatment doors of the hood are locked in the closed state; and further, the left-side and the right-side treatment doors and the end-side treatment door of hood can be easily open in the open state, so that the operability can be improved. Also, in the closed state, the end-side treatment door is restricted to move to the open state, so that the end-side treatment door can be prevented from being open or closed improperly.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a front view showing a door-locking device in an infant incubator of an embodiment according to the present invention.

FIG. **2** is a side view of the door-locking device taken from the direction A of FIG. **1**.

FIG. **3** is a perspective view of an open-close knob.

FIG. **4** is a sectional view of a sealing portion between a foot-side treatment door and a canopy taken along the B-B line of FIG. **10**.

FIG. **5** is a back view showing a canopy gasket taken from the D direction of FIG. **14**.

FIG. **6** is a cross sectional view showing the canopy gasket taken along the line D-D of FIG. **5**.

FIG. **7** is a sectional view showing a sealing portion between a left-side treatment door and the canopy taken along the line C-C of FIG. **14**.

FIG. **8** is a cross sectional view showing a treatment door gasket.

FIG. **9** is a perspective view showing an overall of the infant incubator.

FIG. **10** is a front view showing the left-side treatment door of the infant incubator.

FIG. **11** is a right side view of FIG. **10**.

FIG. **12** is a front view showing a state in which the left-side treatment door is open in a state shown in FIG. **10**.

FIG. **13** is a perspective view showing a state in which the canopy and a heater are elevated in a state shown in FIG. **9**.

FIG. **14** is a left-side view showing the incubator in FIG. **10** but a lower part than a base table in FIG. **10** is omitted.

DETAILED DESCRIPTION OF THE INVENTION

Below, an embodiment of an infant incubator according to the present invention will be described.

[Total Construction of an Infant Incubator]

As totally shown in FIGS. **9** to **11**, an infant incubator **1** is provided with: a pedestal **3** which is movable by casters **2**; a supporting post **4** which is vertically erected on the pedestal **3**; a frame **5** which is provided at a top end of the supporting post **4**; a base table **6** which is set on the frame **5**; a hood **8** which is provided on the base table **6** and surrounds an infant chamber **7**; two guide posts **9** and **10** which are vertically provided at an end portion of the frame **5** and both sides of the hood **8**; a heater **11** which is provided at a top end of one of the guide posts (i.e., the guide post **10**); and a canopy **12** which is set on a top end of the other of the guide posts (i.e., the guide post **9**) and composes a roof of the hood **8**.

The supporting post **4** internally has a lift which moves the frame **5** up and down. A pedal **13** is provided at a side of the pedestal **3** for operating the lift.

The hood **8** is constructed substantially rectangular of: a floor plate **16** in which a bed **15** for laying an infant down is mounted; a left-side treatment door **17** and a right-side treatment door **18** which are disposed each at a left side and a right side of the infant; a foot-side treatment door **19** which is disposed at a foot side of the infant; a head-side treatment door **20** which is disposed at a head side of the infant; and the canopy **12** which closes a top of the infant chamber **7** which is surrounded by the left-side and right-side treatment doors **17** and **18**, the foot-side treatment door **19** and the head-side treatment door **20**. The left-side treatment door **17**, the right-side treatment door **18**, the foot-side treatment door **19**, the head-side treatment door **20** and the canopy **12** are substantially entirely formed from transparent resin, so that the infant in the infant chamber **7** can be checked with eyes from the outside.

FIGS. **9** to **11** show a state in which the hood **8** is closed by moving down the canopy **12**; and FIG. **13** shows a state in which the top of the infant chamber **7** is open by moving up the canopy **12**. Also, FIG. **13** shows a state in which the heater **11** is moved up and the infant chamber **7** is heated.

As described above, the infant incubator **1** has both the functions of forms of an enclosed incubator shown in FIGS. **9** to **11** and an open incubator shown in FIG. **13**.

Among the treatment doors **17** to **20**, the head-side treatment door **20** is maintained in a vertical posture erecting at the head side of the infant chamber **7**. On the other hand, lower ends of the left-side and right-side treatment doors **17** and **18** and the foot-side treatment door **19** are installed swingably around a horizontal shaft (not shown) with respect to the base table **6**. In a case in which the infant incubator **1** is used as the enclosed incubator, the treatment doors **17** to **19** are closed, and the left-side and right-side treatment doors **17** and **18** can be open and closed for taking care of the infant. In FIG. **12**, one side of the infant chamber **7** is open by turning the left-side treatment door **17** in the enclosed mode. In a case in which the infant incubator **1** is used as the open incubator, three sides of the infant chamber **7**, i.e., the left-side treatment door **17**, the right-side treatment door **18** and the foot-side treatment door **19** can be open and closed.

The left-side treatment door **17** and the right-side treatment door **18** have access-port units **25**; and the foot-side treatment door **19** has an access-port unit **26**. When the infant incubator **1** is used as the enclosed incubator, access ports **27** of the access-port units **25** and **26** can be open and closed by access flappers **28** of the access-port units **25** and an access flapper **29** of the access-port unit **26** while the treatment doors **17** to **19** remain standing. The head-side treatment door **20** is provided with grommet members **30** having slits through which cables or tubes are inserted.

On the floor plate **16** in the infant chamber **7**, the bed **15** on which the infant is laid is provided. The bed **15** is swingably held at a center of a longitudinal direction by a horizontal shaft (not illustrated) and an end portion of the head side is held by a lift **31**. By elevating the end portion which is held by the lift **31**, the bed **15** can be held a position which is inclined to the horizontal direction. The lift **31** is provided at an outside of the hood **8**.

The guide posts **9** and **10** each have a coaxial rod **32** and a lift which moves up and down the rod **32** therein. The canopy **12** is attached to an upper end of the rod **32**, can close the infant chamber **7** at a down position thereof by being in

contact with upper ends of the treatment doors **17** to **20**, and can retract from the treatment doors **17** to **20** at an upper position thereof at an enough distance for treatments for the infant. The heater **11** is attached to an upper end of a rod (not illustrated, but provided as the guide post **9** shown in FIG. **13**) of the other guide post **10** rotatably around a horizontal shaft **33**. The heater **11** has: a folding position at a down position by folding vertically and substantially parallel to the guide post **10** as shown in FIG. **9** and so forth; and a heating position at an elevated position for supplying heat wave from above to the infant chamber **7** by raising with a subscribed angle with respect to the vertical direction.

[Construction of Door-Locking Device]

Door-locking devices **40** each are provided at the left-side treatment door **17**, the right-side treatment door **18**, the foot-side treatment door **19** so as to fix the foot-side treatment door **19** with the left-side treatment door **17** and the right-side treatment door **18** in a state in which the treatment doors **17** to **19** are erected.

As shown in FIG. **1** and FIG. **2**, the door-locking devices **40** each are formed from an open-close knob **41** which is rotatably attached to the left-side treatment door **17** and the right-side treatment door **18**, and a knob bracket **46** which is fixed to each side of the foot-side treatment door **19**.

The open-close knob **41** is, as shown in FIG. **1** and FIG. **3**, formed from a hook portion **43** which is protruded perpendicularly from each surface of the left-side and right-side treatment doors **17** and **18** and a thin-walled portion which is hooked on the knob bracket **46**, so that the hook portion **43** and the thin-walled portion **44** are formed integrally at an end portion of a lever portion **42** which is parallel to each surface of the left-side and right-side treatment doors **17** and **18**. A base-end portion **45** of the lever portion **42** is held by a pin to the left-side and right-side treatment doors **17** and **18** rotatably along each surface of the left-side and right-side treatment doors **17** and **18**. By inserting the thin-walled portion **44** of the open-close knob **41** into a hollow portion **47** of the knob bracket **46** and protruding the hook portion **43** from the knob bracket **46** so as to hook a side surface of the knob bracket **46**, the left-side treatment door **17**, the right-side treatment door **18** and the foot-side treatment door **19** are inhibited from rotating, so that the treatment doors **17** to **19** are fixed each other to standing states.

[Configuration of Treatment-Door Gasket and Canopy Gasket]

A treatment-door gasket **51** and a canopy gasket **61** are provided between the treatment doors **17** to **20** and the canopy **12** of the hood **8** so as to hold the treatment doors **17** to **20** and the canopy **12** in a closed state when the canopy **12** is moved down so as to be set to the closed state. The treatment-door gasket **51** is, as shown in FIG. **7**, mounted on each top end of the left-side treatment door **17** and the right-side treatment door **18** between the canopy **12** and the left-side and right-side treatment doors **17** and **18** in the closed state. The canopy gasket **61** is, as shown in FIG. **4**, mounted on a front surface and a back surface of the canopy **12** with inserting a canopy frame **71** therebetween, and is disposed between the foot-side treatment door **19** and the canopy **12** and between the head-side treatment door **20** and the canopy **12**.

The treatment-door gasket **51** is, shown as FIGS. **7** and **8**, formed integrally from a fixing portion **52** having a U-shape in section which is fixed along each top ends of the left-side treatment door **17** and the right-side treatment door **18**; a sealing portion **53** which extends from the fixing portion **52**. A hollow groove **54** is formed at the fixing portion **52** so as to fit and to cover a protruded ridge **21** which is formed at each top ends of the treatment doors **17** and **18**. The sealing portion **53** is formed as a thin-walled belt-plate, is bent at a distal-end portion **55** thereof inwardly and downwardly, and is protruded upwardly at a bulge portion **56**. The sealing portion **53** is in contact with an outer peripheral surface of the canopy **12** at an inner peripheral surface of the distal-end portion **55** which is bended inwardly and downwardly in a state in which the left-side treatment door **17** and the right-side treatment door **18** are closed with respect to the canopy **12**, so that a gap between the left-side treatment door **17** and the canopy **12** and a gap between the right-side treatment door **18** and the canopy **12** are sealed. As a result, the left-side treatment door **17** and the right-side treatment door **18** can be open and closed in a state in which the canopy **12** is closed.

The same canopy gaskets **61** are mounted on the foot-side treatment door **19** and the head-side treatment door **20**. As described above, the head-side treatment door **20** is constructed to stand so as not to move. Below, the foot-side treatment door **19** will be described.

The canopy frame **71** is formed to have a bar-shape along a lower end portion of the canopy **12**, mounted to the lower end portion by screws or the like, and has an arc-shape in section. Protruded ridges **72** and **73** are each formed at both sides of the canopy frame **71** so as to be inserted into the canopy gasket **61**.

As shown in FIGS. **4** to **6**, a fixing portion **62** which is fixed along the canopy frame **71** and has an arc-shape in section; a vertical-wall portion **64** having a sealing portion **63** which is in contact with an inner surface of the foot-side treatment door **19**; a connecting portion **65** which connects the fixing portion **52** and the vertical-wall portion **64**; a protruded-ridge portion **66** which is provided along an outer surface of the foot-side treatment door **19**; and protruded portions **67** which protrude higher than the protruded-ridge portion **66** at the outside of the protruded-ridge portion **66** are formed integrally in the canopy gasket **61**.

A hollow groove **68** in which the protruded ridge **72** of the canopy frame **71** is inserted is formed at an upper end portion of an arc-shaped inner peripheral portion of the fixing portion **62** so that the fixing portion **62** covers the canopy frame **71**. Also, hollow groove **69** in which the protruded ridge **73** of the canopy frame **71** is inserted is formed at a lower end portion of the arc-shaped inner peripheral portion of the fixing portion **62** so that the fixing portion **62** covers the canopy frame **71**. The sealing portion **63** having upper and lower two-tiered shape is formed integrally to the vertical-wall portion **64** so as to extend obliquely upward. The sealing portions **63** are in contact with the inner surface of the foot-side treatment door **19** in the closed state so as to seal between the foot-side treatment door **19** and the canopy **12**. In the protrude-ridge portion **66**, a distance to the vertical-wall portion **64** is smaller than a thickness of a wall of the foot-side treatment door **19**; and a part of the protruded-ridge portion **66** covers the outer peripheral edge of the top end surface of the foot-side treatment door **19**. As shown in FIG. **5** and FIG. **14**, three protruded-ridge portions **66** are formed along the outer peripheral surface of the foot-side treatment door **19**. Further, the protruded-ridge portion **66***a* which is disposed at the center of the tree protruded-ridge portions **66** is formed longer than the protruded-ridge portions **66***b* which are disposed at both sides thereof. The two protruded portions **67** are each disposed between the center protruded-ridge portion **66***a* and the protruded-ridge portions **66***b* at the both sides of the center protruded-ridge portion **66***b*.

The canopy gasket **61** is formed so that the upper end portion of the foot-side treatment door **19** is fitted between the vertical-wall portion **64** and the protruded-ridge portion **66**, when the canopy **12** is moved down so that the hood **8** is

closed (i.e., the closed state). As a result, the canopy gasket **61** aligns the canopy **12** and the foot-side treatment door **19** and seals between the canopy **12** and the foot-side treatment door **19**. In this case, the foot-side treatment door **19** is kept standing by the canopy gasket **61**. Moreover, when the fixations by the door-locking devices **40** are cancelled so that the left-side and right-side treatment doors **17** and **18** are in the open state, the foot-side treatment door **19** is restricted not to move to the opening direction. Furthermore, since the part of the protruded-ridge portion **66** covers the outer peripheral edge of the top end surface of the foot-side treatment door **19**, the foot-side treatment door **19** is pressed toward the inside of the infant chamber **7**, so that the sealing property between the vertical-wall portion **64** of the canopy gasket **61** and the foot-side treatment door **19** can be improved.

[Open-and-Close Operation of the Treatment Door]

As shown in FIG. **13**, the open-and-close operation of the left-side treatment door **17**, the right-side treatment door **18**, and the foot-side treatment door **19** in a case in which the canopy **12** is moved up and the infant chamber **7** is in open state will be described.

When the left-side treatment door **17**, the right-side treatment door **18**, and the foot-side treatment door **19** are open from the state in which the treatment doors **17** to **20** are closed by the door-locking devices **40**, as shown by an outlined allow in FIG. **1**, the hook portion **43** of the open-close knob **41** of the door-locking device **40** is rotated so as to point upward (rotated counterclockwise in FIG. **1**) so that the lever portion **42** of the open-close knob **41** is unfastened from the inside of the knob bracket **46**. As a result, the left-side treatment door **17** and the foot-side treatment door **18** are unfixed to the foot-side treatment door **19**. Then, the treatment doors **17** to **19** are open by rotating the treatment doors **17** to **19**.

In order to recover the treatment doors **17** to **19** to the stand state, by inverse operation to the abovementioned operation, the treatment doors **17** to **19** are stood; the lever portion **42** of the open-close knob **41** is inserted into the hollow portion **47** of the knob bracket **46**; and the hook portion **43** is protruded from the knob bracket **46** so as to be held by hooking a side surface of the knob bracket **46**. As a result, the left-side treatment door **17** and the right-side treatment door **18** are prevented from rotating, and also the foot-side treatment door **19** is prevented from rotating, so that the treatment doors **17** to **19** are fixed in the stand state with each other. Therefore, the foot-side treatment door **19** can be reliably locked when the left-side and right-side treatment doors **17** and **18** are locked.

As described above, by forming the top end of the open-close knob **41** as a hook-shape, the foot-side treatment door **19** can be locked and is prevented from being open improperly by utilizing the door-locking devices **40** of the left-side and right-side treatment door **17** and **18** even though it is a simple mechanism. Moreover, the left-side and right-side treatment door **17** and **18** and the foot-side treatment door **19** can be easily open by canceling the fitting of the open-close knob **41** and the knob bracket **46** when the treatment door **17** to **19** are open.

[Open-and-Close Operation of Canopy]

It will be described that the infant camber **7** is switched to closed state by moving down the canopy **12** as shown in FIG. **9** from the state in which the canopy **12** is moved up so as to open the upper part of the infant chamber **7** as shown in FIG. **13**.

In the state in which the treatment doors **17** to **20** are closed by the door-locking devices **40**, if the canopy **12** is moved down, the canopy gaskets **61** which are attached to the canopy **12** are moved along with the canopy **12**, so that the canopy gaskets **61** are each disposed between the foot-side treatment door **19** and the canopy **12** and the head-side treatment door **20** and the canopy **12**. In this case, the upper end portion of the foot-side treatment door **19** is fit inserted between the vertical-wall portion **64** and the protruded-ridge portion **66** both are provided at the canopy gasket **61**, so that the canopy **12** and the foot-side treatment door **19** are aligned and a gap between the canopy **12** and the foot-side treatment door **19** is sealed.

The gap between the canopy **12** and the left-side treatment door **17** is sealed by the treatment-door gasket **51** which is mounted on the left-side treatment door **17**. Also, the gap between the canopy **12** and the right-side treatment door **18** is sealed by the treatment-door gasket **51** which is mounted on the right-side treatment door **18**. The sealing portion **53** of the treatment-door gasket **51** is formed so as to protrude upward at the bulge portion **56**. The distal-end portion **55** is pressed outward along with moving down of the canopy **12** and kept being in contact with the outer peripheral surface of the canopy **12**, so that the gap between the left-side treatment door **17** and the canopy **12** and the gap between the right-side treatment door **18** and the canopy **12** are sealed.

Next, the open-close operation of the left-side treatment door **17** and the right-side treatment door **18** in the closed state of the infant chamber **7** will be described.

As shown by the outlined allow in FIG. **1**, by rotating the hook portion **43** of the open-close knob **41** of the door-locking device **40** so as to point upward (rotated counterclockwise in FIG. **1**), so that the lever portion **42** of the open-close knob **41** is unfastened from the inside of the knob bracket **46**. As a result, the left-side treatment door **17** and the foot-side treatment door **18** are unfixed to the foot-side treatment door **19** and the head-side treatment door **20**. In this case, the foot-side treatment door **19** is kept standing since the upper end portion thereof is fixed by the canopy gasket **61**, even though the foot-side treatment door **19** is unfixed to the left-side treatment door **17** and the right-side treatment door **18**. In this state, by rotating the left-side treatment door **17** and the right-side treatment door **18**, the treatment doors **17** and **18** can be open. FIG. **12** shows a state in which only the left-side treatment door **17** is open.

Then, in order to recover the left-side treatment door **17** and the right-side treatment door **18** to the stand state, by inverse operation to the abovementioned operation, the treatment doors **17** and **18** are stood; the lever portion **42** of the open-close knob **41** is inserted into the hollow portion **47** of the knob bracket **46**; and the hook portion **43** is protruded from the knob bracket **46** so as to be held by hooking a side surface of the knob bracket **46**. In the closed state of the left-side treatment door **17** and the right-side treatment door **18**, the inner peripheral surface of the distal-end portion **55** of the treatment-door gasket **51** is in contact with the outer peripheral surface of the canopy **12**, so that the gap between the left-side treatment door **17** and the canopy **12** and the gap between the right-side treatment door **18** and the canopy **12** are sealed.

As described above, the foot-side treatment door **19** can be held to stand when the fixation of the left-side treatment door **17** to the foot-side treatment door **19** and the fixations of the right-side treatment door **18** to the foot-side treatment door **19** by the door-locking devices **40** are cancelled. Therefore, the foot-side treatment door **19** is restricted not to move to the opening direction in the closed state of the canopy **12**, so that the foot-side treatment door **19** can be prevented from being open improperly. Moreover, since the protruded portions **67** which protrude higher than the protruded-ridge portion **66** at the outside of the protruded-ridge portion **66** of the canopy

gasket **61**, the foot-side treatment door **19** can be reliably prevented from being open improperly in the closed state.

The present invention is not limited to the above-described embodiments and various modifications may be made without departing from the scope of the present invention.

In the above embodiment, the foot-side treatment door **19** and the head-side treatment door **20** are disposed with respect to the left-side and right-side treatment doors **17** and **18** as shown in FIG. **9** and the like. However, it can be supposed to be used with reversing the foot side and the head side according to the position of the infant in the infant chamber **7**. In this case, the foot-side treatment door **19** on which the access-port unit **26** is mounted is at the head side of the infant.

In the above embodiment, the reference symbol **19** represents the foot-side treatment door, and the reference symbol **20** represents the head-side treatment door. However, since a case in which the reference symbol **20** represents the foot-side treatment door can be supposed, the foot-side treatment door and the head-side treatment door are designated as the end-side treatment doors.

What is claimed is:

1. An infant incubator comprising an infant chamber which can switch states between a closed state and an open state by opening and closing a hood, wherein:

the hood comprises a side wall part and a canopy which is separated from the side wall part and wherein the canopy can be moved up and down,

the side wall part comprises: a left-side treatment door configured to be disposed at a left side of an infant and a right-side treatment door configured to be disposed at a right side of the infant, which are rotatably held between an erection state and open state; an end-side treatment door configured to be disposed at at least one of a head side or a foot side of the infant, which is rotatably held between an erection state and open state; and a door-locking device which locks the left-side treatment door and the right-side treatment door with respective sides of the end-side treatment door,

wherein the door-locking device comprises: an open-close knob comprising a hook end, which is attached to the left-side treatment door or the right-side treatment door; and a knob bracket comprising a hollow portion to which the hook end is engaged, which is attached to a side of the end-side treatment door, and

the left-side treatment door and the right-side treatment door are fixed with the end-side treatment door in the erection state by engaging the hook end of the open-close knob and the hollow portion of the knob bracket.

2. The infant incubator according to claim **1**, wherein

the canopy has a canopy gasket which is in contact with a top end portion of the end-side treatment door and maintains the canopy to close the end-side treatment door in the closed state,

the canopy gasket is provided with a vertical-wall portion having a sealing portion which is in contact with an inner surface of the end-side treatment door and a protruded ridge which is provided along an outer surface of the end-side treatment door, and

the top end portion of the end-side treatment door is fitted between the vertical-wall portion and the protruded ridge in the closed state.

3. The infant incubator according to claim **2**, wherein the canopy gasket is provided so that a part of the protruded ridge reaches to an outer periphery of a top end surface of the end-side treatment door.

4. The infant incubator according to claim **2**, wherein the canopy gasket is provided with a protruded portion at an outside of the protruded ridge so as to protrude higher than the protruded ridge.

5. An infant incubator comprising an infant chamber which can switch states between a closed state and an open state by opening and closing a hood, wherein:

the hood comprises a side wall part and a canopy which is separated from the side wall part and wherein the canopy can be moved up and down,

the side wall part configured for receiving an infant comprises:

a left-side treatment door configured to be disposed at a left side of the infant and a right-side treatment door configured to be disposed at a right side of the infant, which are rotatably held between an erection state and open state; an end-side treatment door configured to be disposed at at least one of a head side or a foot side of the infant, which is rotatably held between an erection state and open state; and a door-locking device which locks the left-side treatment door and the right-side treatment door with respective sides of the end-side treatment door,

wherein the door-locking device comprises: an open-close knob which is attached to the left-side treatment door or the right-side treatment door and has a hook end; and a knob bracket which is attached to a side of the end-side treatment door and has a hollow portion to which the hook end is engaged, and

the left-side treatment door and the right-side treatment door are fixed with the end-side treatment door in the erection state by engaging the hook end of the open-close knob and the hollow portion of the knob bracket.

6. The infant incubator according to claim **5**, wherein

the canopy has a canopy gasket which is in contact with a top end portion of the end-side treatment door and maintains the canopy to close the end treatment door in the closed state,

the canopy gasket is provided with a vertical-wall portion having a sealing portion which is in contact with an inner surface of the end treatment door and a protruded ridge which is provided along an outer surface of the end treatment door, and

the top end portion of the end treatment door is fitted between the vertical-wall portion and the protruded ridge in the closed state.

7. The infant incubator according to claim **6**, wherein the canopy gasket is provided so that a part of the protruded ridge reaches to an outer periphery of a top end surface of the end treatment door.

8. The infant incubator according to claim **6**, wherein the canopy gasket is provided with a protruded portion at an outside of the protruded ridge so as to protrude higher than the protruded ridge.

9. An infant incubator comprising an infant chamber which can switch states between a closed state and an open state by opening and closing a hood, wherein:

the hood comprises a side wall part and a canopy which is separated from the side wall part and wherein the canopy can be moved up and down,

the side wall part comprises: a first-side treatment door disposed at a first-side and a second-side treatment door disposed at a second side, which are rotatably held between an erection state and open state; an end treatment door disposed at at least one of a third side or a fourth side, which is rotatably held between an erection state and open state; and a door-locking device which

locks the first-side treatment door and the second-side treatment door with respective sides of the end treatment door,

wherein the door-locking device comprises: an open-close knob which is attached to the first-side treatment door or the second-side treatment door and has a hook end; and a knob bracket which is attached to a side of the end treatment door and has a hollow portion to which the hook end is engaged, and

the first-side treatment door and the second-side treatment door are fixed with the end treatment door in the erection state by engaging the hook end of the open-close knob and the hollow portion of the knob bracket.

* * * * *